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ADVENTURES IN THE WORLD OF SCIENCE

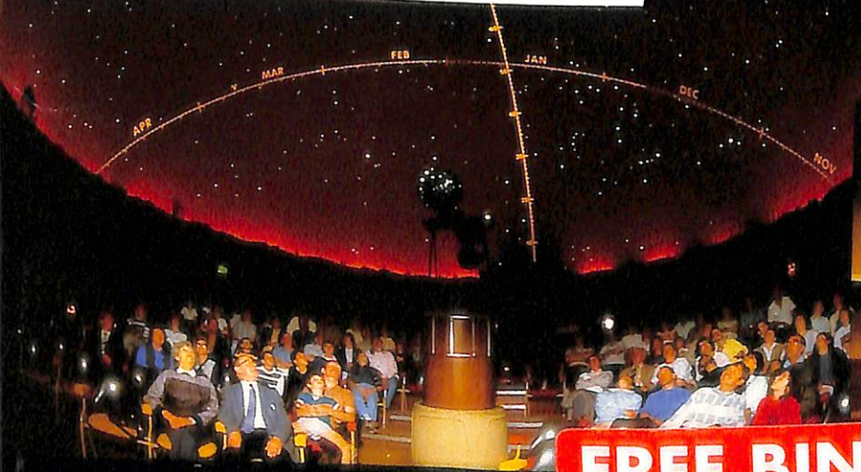
ENTERTAINMENT 41

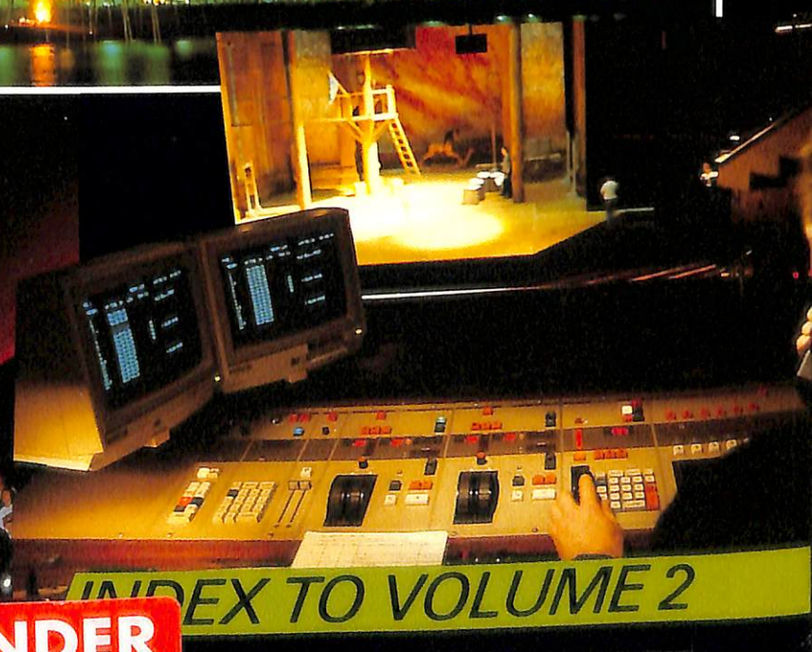
MAKE AN OMNIMAX CINEMA

FACT FILES ON:
- Natural wonders
- Planetarium projectors
- Outside broadcasts
- Fireworks
- Oceanariums
- Staging a show
- Film animation

GIANT POSTER

THREE PROJECTS





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FACT FILES

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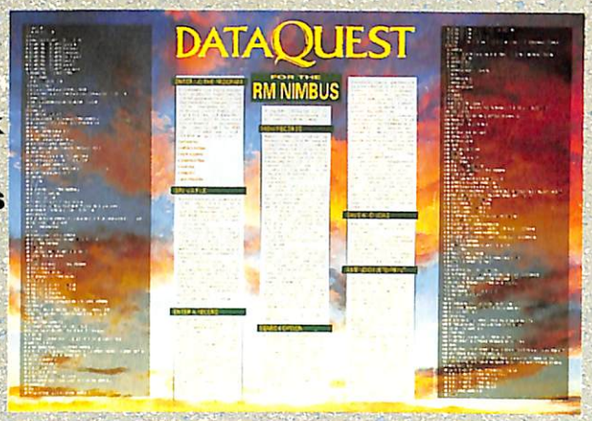
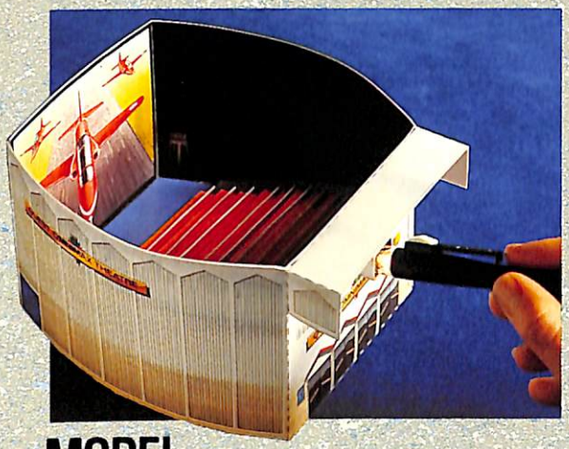


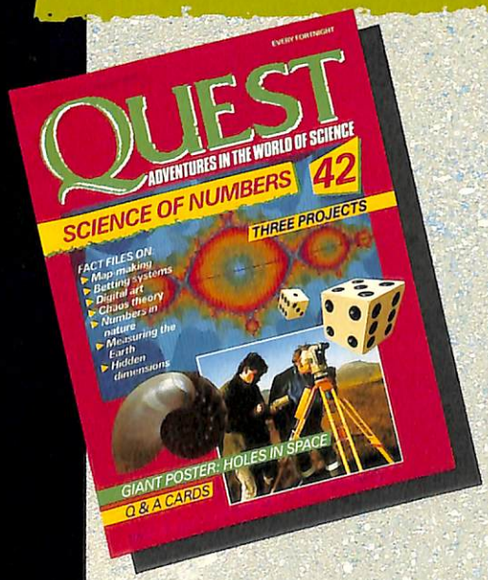
POSTER Nimbus computer database



MODEL Omnimax cinema

THREE SCIENTIFIC PROJECTS

IN QUEST 42 THE SCIENCE OF NUMBERS



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- ▶ Games of chance
- ▶ Map making
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- ▶ Beyond the third dimension
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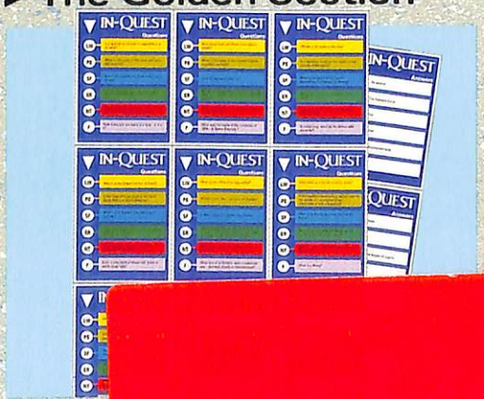

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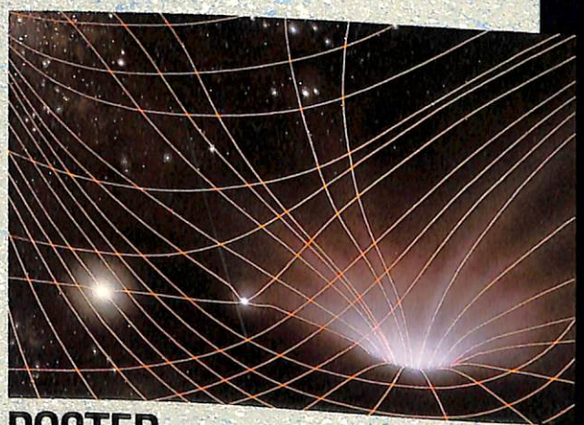

POSTER Black holes

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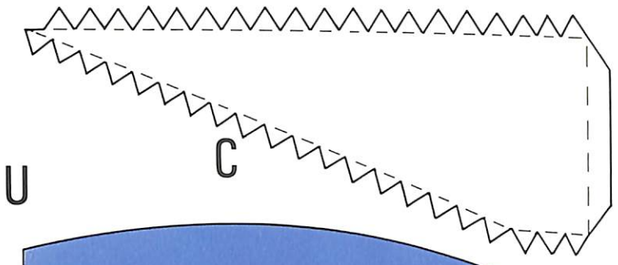
OMNIMAX CINEMA


U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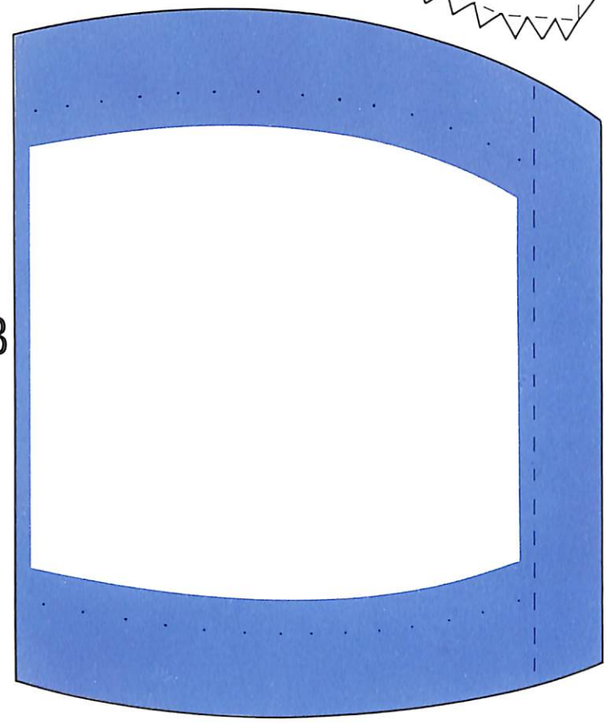
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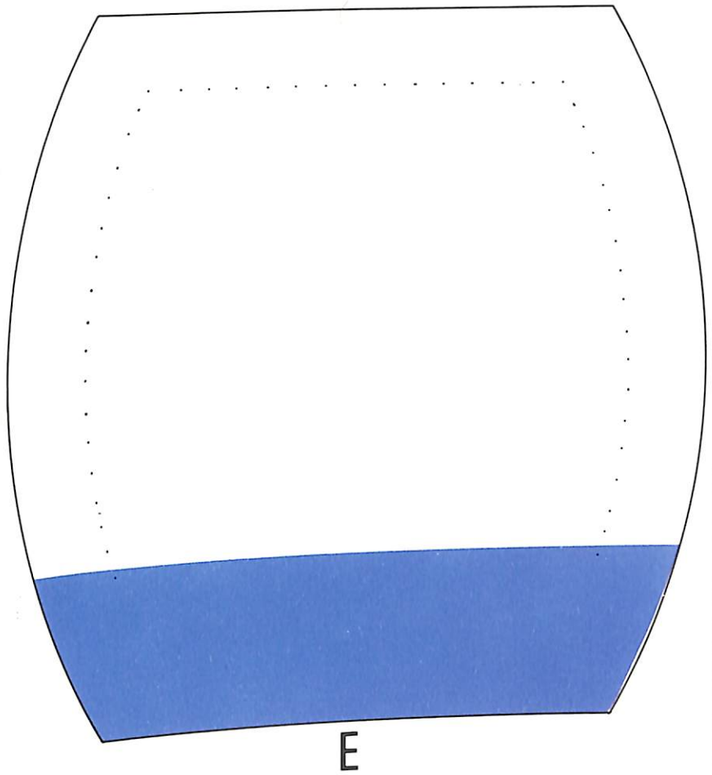
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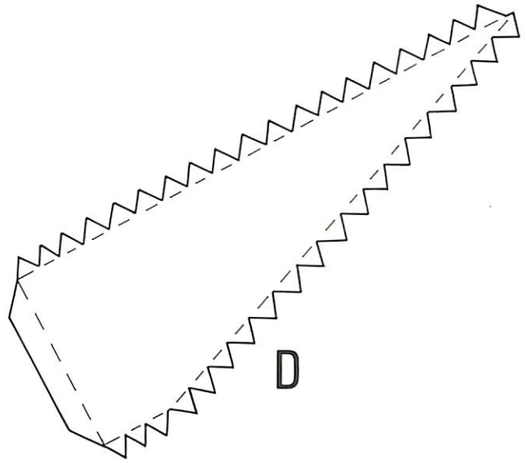
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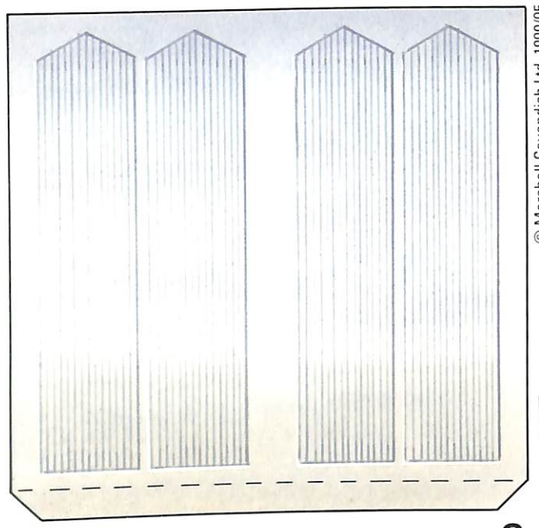
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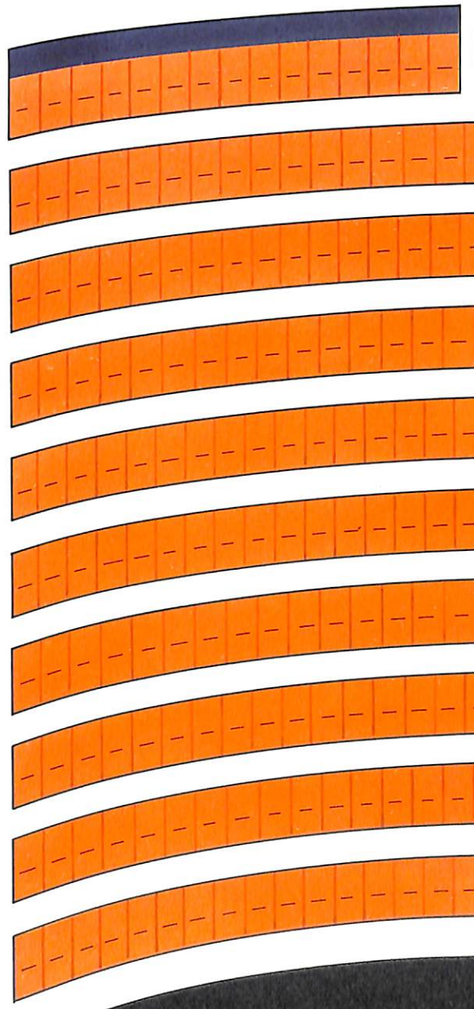
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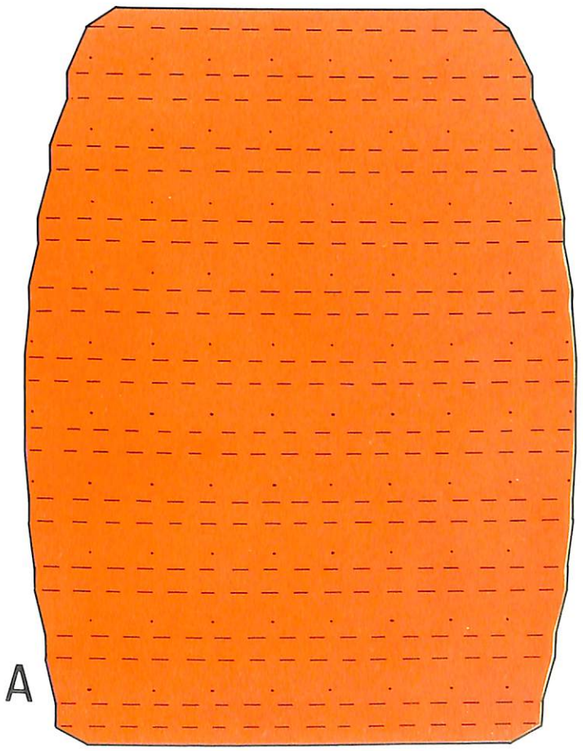
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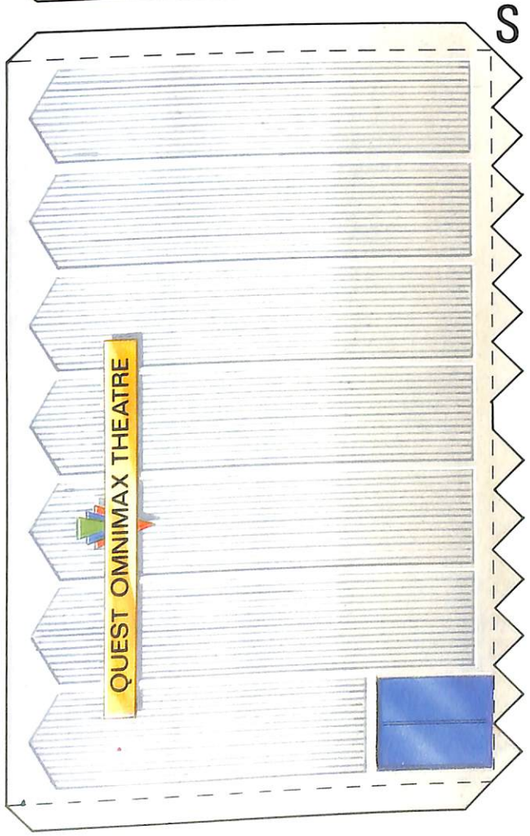

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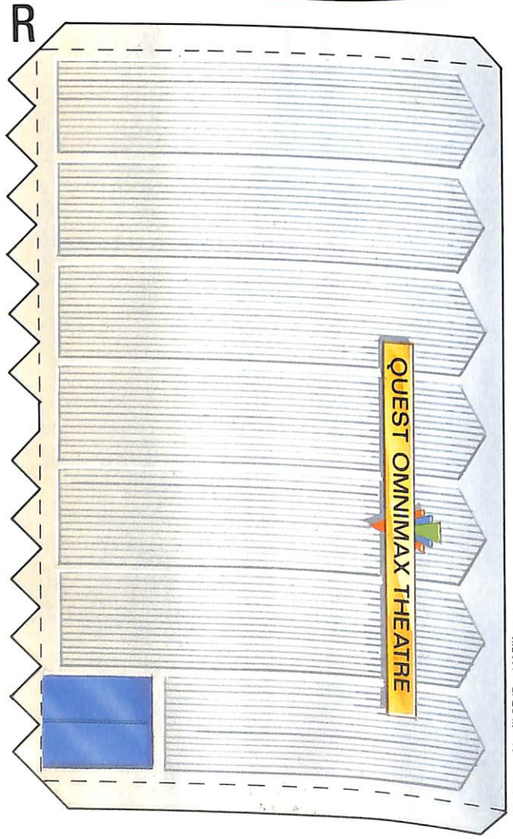

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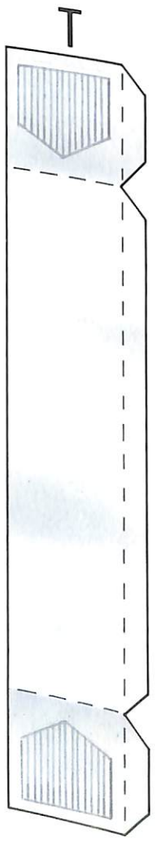

T

James Nevill 3D/Paul Williams

DATA

FOR RM NI

```
5 CLEAR 400
7 ON ERROR GOTO 20
10 R := 0
20 HOME : CLS : PRINT " M A I N  M E N U "
30 PRINT : PRINT : PRINT "1: Open a file"
40 PRINT : PRINT : PRINT "2: Enter a record"
50 PRINT : PRINT : PRINT "3: View records"
60 PRINT : PRINT : PRINT "4: Search option"
70 PRINT : PRINT : PRINT "5: Save file"
80 PRINT : PRINT : PRINT "6: Load file"
90 PRINT : PRINT : PRINT "7: Quit program"
100 PRINT : PRINT " – SELECT OPTION – "
120 IS := GETS(1)
130 IF IS = "" THEN GOTO 120
140 Choice := VAL(IS)
150 IF Choice > 7 OR Choice < 1 THEN GOTO 120
160 IF R = 0 AND Choice <> 1 AND Choice <> 6 AND Choice <> 7 THEN GOTO 120
170 HOME : CLS
180 ON Choice GOSUB 210, 400, 610, 750, 1060, 1190, 1320
190 GOTO 20
210 HOME : CLS
220 PRINT "ARE YOU SURE?"
225 ConfirmS := GETS(1) : IF ConfirmS = "" THEN GOTO 225
230 IF ConfirmS <> "Y" AND ConfirmS <> "y" THEN RETURN
240 HOME : CLS
250 PRINT " CREATE A NEW FILE "
260 IF R > 0 THEN CLEAR 400
270 INPUT "Number of fields (1-8) "; A
280 IF A < 1 OR A > 8 THEN GOTO 270
290 DIM DS(A) : DIM NS(A) : DIM G(A) : DIM B(A + 1) : T := 0
300 FOR N := 1 TO A
310 PRINT "Name of field "; N; " ? " : INPUT NS(N)
330 PRINT "Length of field "; N; " ? " : INPUT G(N)
340 IF G(N) > 50 THEN GOTO 330
350 B(N) := T : T := T + G(N) : NEXT : B(N) := T
360 INPUT "How many records"; R
370 DIM AS(R)
380 GOTO 190
400 C := 1
420 IF LEFTS(AS(C), 1) = "" THEN GOTO 460
430 IF C = R THEN GOTO 580
440 C := C + 1 : GOTO 420
460 PRINT C – 1; " out of "; R; " records in use"
470 PRINT : FOR N := 1 TO A : PRINT NS(N); "? (up to "; G(N); " characters)"
480 INPUT DS(N) : IF LEN(DS(N)) > G(N) THEN GOTO 480
481 PRINT DS(N)
485 IF LEN(DS(N)) < G(N) THEN FOR M := LEN(DS(N)) + 1 TO G(N) : DS(N) := DS(N) + " " : NEXT
490 AS(C) := AS(C) + DS(N) : NEXT
500 IF C = 1 THEN RETURN
510 N := C
530 IF AS(C) >= AS(C – 1) THEN RETURN
540 XS = AS(C) : AS(C) = AS(C – 1) : AS(C -1) = XS : C = C – 1
550 IF C = 1 THEN RETURN
560 GOTO 530
580 HOME : CLS : PRINT : PRINT " F I L E  F U L L "
585 FOR F = 1 TO 2000 : NEXT F
590 RETURN
610 D := 1 : IF LEFTS(AS(1), 1) = "" THEN RETURN
630 IF D = 0 THEN D := 1
640 IF D – 1 = R THEN D = D – 1
650 IF LEFTS(AS(D), 1) = "" THEN D:= D – 1
670 GOSUB 1920
680 IF Op = 1 THEN D := D + 1 : GOTO 630
690 IF Op = 2 THEN D := D – 1 : GOTO 630
700 IF Op = 3 THEN RETURN
710 IF Op = 4 THEN GOSUB 1380
720 IF Op = 5 THEN Md := 1 : GOSUB 1650 : IF D = 0 THEN RETURN
730 GOTO 670
750 FOR N := 1 TO A : PRINT : PRINT N; TAB (11); ":- "; NS(N) : NEXT
760 PRINT : PRINT : PRINT "SEARCH WHICH FIELD (1 TO "; A; ")?"
770 YS := GET$(1)
780 IF YS = "" THEN GOTO 770
800 IF VAL(YS) < 1 OR VAL(YS) > A THEN GOTO 770
810 Z := VAL(YS) : PRINT : PRINT "Search field "; Z; " for what ?"
820 INPUT ZS
821 IF LEN(ZS) < G(Z) THEN FOR M := LEN(ZS) + 1 TO G(Z) : ZS := ZS + " " : NEXT
830 HOME : CLS : K := 1
850 IF MIDS(AS(K), B(Z) + 1, G(Z)) = ZS THEN GOTO 900
870 IF K = R OR LEFTS(AS(K), 1) = "" THEN HOME : CLS : PRINT " NO RECORDS WITH "; ZS; " IN
FIELD "; Z : FOR F := 1 TO 4000 : NEXT F : GOTO 20
880 K := K + 1 : GOTO 850
900 D := 1 : Pm := 1 : Mo := 1
920 IF D > R THEN D = Pm
930 IF D = 0 THEN D := Pm
940 IF LEFTS(AS(D), 1) = "" THEN D := Pm
950 IF MIDS(AS(D), B(Z) + 1, G(Z)) <> ZS THEN D := D + Mo : GOTO 920
970 GOSUB 1920
980 Pm := D
990 IF Op = 1 THEN Mo := 1 : D := D + Mo : GOTO 920
```

ENTERING THE PROGRAM

It is essential to type in the program exactly as instructed to avoid computer errors. In particular, notice where the spaces are and be careful to distinguish between zero and the letter O. You might find it easier – and less daunting – to type in short sections of the program at a time, say 20-30 lines. Check each block carefully on the screen before going on to the next. Once you have completed the program, SAVE it. Then RUN it and the seven options available on the MAIN MENU will appear on the screen:

1 OPEN A FILE

2 ENTER A RECORD

3 VIEW RECORDS

4 SEARCH OPTION

5 SAVE FILE

6 LOAD FILE

7 QUIT PROGRAM

OPEN A FILE

When you open a new file, you will need to tell the computer how many records you want, and the maximum length each record can be. **Open a file** is option 1 on the MAIN MENU, so press the 1 key. The words 'Are you sure?' will flash up on the screen. Press Y to continue.

The computer will ask you how many 'fields' – items of information – you want to store in each record. For example, you are a keen astronomer, the fields you need might be: name of star, position, brightness, date when observed – four in all. The maximum number of fields in any individual record is eight..

Next, the computer will ask, 'Name of first field?' In the example above, your answer would be STAR. It will then ask the length of the first field – that is, the maximum number of characters the first field is to hold. This program allows for a maximum of 50 characters. If the information you want to store is longer, you can divide the field into two or more pieces.

You will be asked to specify how many records you actually want.

ENTER A RECORD

When you have completed the procedure, the program will automatically take you back to the MAIN MENU. Now select option 2 to start entering your records.

At the top of the screen, the computer will keep a running tally of how many records you enter, along with the total space in the store. Under this line, the computer will display the field names.

Key in the details you want recorded under each field heading. Keep them as short as possible and within the maximum character length you have set. Press the ENTER or RETURN key, and the information you have keyed in will be printed out next to the field name. The bottom of the screen will clear, ready for you to key in the next piece of information.

The computer starts with the first field at the top of the scree
down the screen eac
mation and press RET

VIEW RECORD

Option 3 enables y
records you have en
display the first record
first one according t
selection method. Co
arranging alphabetic
But broadly, they
in alphabetical orde
more than one reco
letter, it orders them
and then by the third
can be problems.

The first arises wh
in the first field. The
any number before
through the same ord
digit, when deciding
rather than looking
whole. In other word
with the first fields,
from 1 to 100, the com
10, 11, 12, 13, 14, 15, 1
it got around to 2, 20, 2

The way round t
records 001, 002, ..
Or better still, avoid
in the first field.

The second proble
mixture of capital an
because the comput
ahead of lower case
ahead of 'Aaron'. You
venient to list everythi

When viewing the
displayed near the b
F(orward) B(ack) M(
and the computer w
record; press F rep
flip through the whole
The B key takes you
the records, so you
and forwards throug
and B keys.

Pressing M will re
MENU at any point.

SEARCH OPTI

This option allows y
any of the fields for
particular piece of info

Press the 4 key, a
ask you which field yo
in the number of the f
for the second, 3 for
counting from the top
then ask you what yo
field for, so key in th
should look for in tha
EVEREST, or APOLLO,
press RETURN or ENT

The word or numb
exactly what is writter

QUEST

THE MBUS

and works its way
ime you key in infor-
RN or ENTER.

S

to look over the
ed. The screen will
not necessarily the
he program's own
uters' methods of
rder vary slightly.
ect the records
the first field. If
as the same first
he second letter,
so on. But there

ou have numbers
nputer will select
letter but it goes
g method, digit by
etween numbers,
the numbers as a
if you fed in records
arrying the numbers
puter would select 1,
17, 18 and 19 before
and so on.
is is to number the
010, 011, up to 100.
sing numbers at all

n arises if you use a
lower case letters,
r chooses capitals
So 'ABC' would be
nay find it more con-
g in capitals.
ecords, you will see
ottom of the screen
nu). Press the F key,
ill display the next
eatedly, and it will
file, record by record.
backwards through
can run backwards
h the file using the F

urn you to the MAIN

ON

u to **search** through
ecords containing a
rmation.
nd the computer will
u want to **search**. Key
elds – 1 for the first, 2
the third and so on,
of the screen. It will
u want to **search** that
e word or number it
t field. For example,
GREAT WHITE – then
ER.
er you key in must be
in the field. If a word

is stored in the records in capital letters and you are searching for it in small letters, the computer will not find it. Even the spaces left between words must correspond exactly. If by mistake, you have left a space before the entry in the record, or accidentally hit the space bar after the entry, the computer will probably not find it.

If the computer cannot find any records with the word you have asked for, it will tell you and return to the MAIN MENU. Otherwise it will list records in alphabetical order. Every record has two lines of options at the bottom of the screen. The first is F(orward) B(ack) M(enu). These work in the same way as before – the F key advancing through the records one by one, the B key taking you backwards through the records, M taking you direct to the MAIN MENU.

Perhaps the most useful application of the search option is to find one particular record using only one word. For example, if you are storing a list of countries of the world, and had the following fields set up: country, capital, area in sq km, population and currency, you could find a record by keying in only the currency used in that country. If the currency was not exclusive to that record you could call up the countries using that currency and flick through them until you found the right one.

SAVE AND LOAD

When you want to save your file, press the 5 key and the computer will ask you to give the file a filename.

To consult your files, first **load** the program using your machine's normal **load** routine and RUN it. Press the 6 key and the computer will ask you for the name of the file you want to see. When you have keyed in the filename and pressed the RETURN key, the machine will load the required file.

AMEND/DELETE/PRINT

The second line of options that appears with each record is A(mend) D(elete) P(rint). Press the A key and the computer will ask 'Which field number?' When you have keyed in the number of the field you want to amend, counting from the top as before, you will be asked to 'ENTER MODIFICATION'. Key in the whole of the new field you want to enter, even if there is only one letter you want to amend. When you press the RETURN or ENTER key, the computer will incorporate your amendment in the appropriate place.

To delete a record, first locate it by using the **search** or **view** options. After you press D, the computer will ask 'Are you sure?' To continue, press Y, and the computer will delete that record and display the next one – either the next one picked alphabetically if you are in the **view** mode, or the next one that has the same field that you have been searching if you are in the **search** mode.

Once you have checked that the printer is connected and switched on, press theP key to start printing. If you press P without the printer being attached, or if the printer does not work, press BREAK and come out of the program. To get back in again, key in GOTO 20.

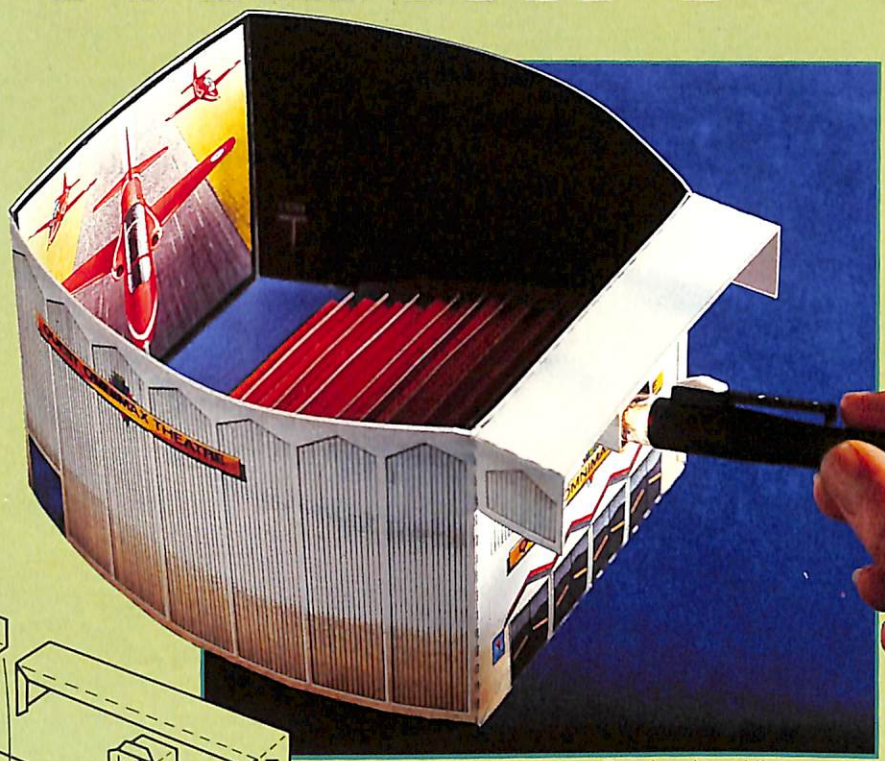
```
1000 IF Op = 2 THEN Mo := - 1 : D := D + Mo : GOTO 920
1010 IF Op = 3 THEN RETURN
1020 IF Op = 4 THEN GOSUB 1380
1030 If Op = 5 THEN Df := 0 : Md := 2 : GOSUB 1650 : IF Df = V OR LEFTS(AS(1),1) = "" THEN
RETURN
1040 GOTO 970
1060 INPUT "Enter file name "; QS : IF LEN(QS) < 1 OR LEN(QS) > 255 THEN GOTO 1060
1070 CREATE #11, QS
1080 PRINT #11 R, A
1090 FOR N := 1 TO A
1100 PRINT #11 NS(N); ",", G(N), B(N)
1110 NEXT
1120 PRINT #11 B(N)
1130 FOR M := 1 TO R
1140 PRINT #11 AS(M)
1150 NEXT
1160 CLOSE #11
1170 RETURN
1190 IF R > 0 THEN CLEAR 400
1191 INPUT "Enter file name "; XS : IF LEN(XS) < 1 OR LEN(XS) > 8 THEN GOTO 1191
1200 OPEN #11, XS
1210 INPUT #11, R, A : DIM NS(A) : DIM G(A) : DIM B(A + 1)
1220 FOR N := 1 TO A
1230 INPUT #11, NS(N), G(N), B(N)
1240 NEXT
1250 INPUT #11, B(N) : DIM AS(R)
1260 FOR M := 1 TO R
1270 INPUT #11, AS(M)
1280 NEXT
1290 DIM DS(A) : CLOSE #11
1300 GOTO 190
1320 PRINT "Are you sure?"
1330 RS := GETS(1)
1340 IF RS = "" THEN GOTO 1330
1350 IF RS <> "Y" AND RS <> "y" THEN RETURN
1360 HOME : CLS : END
1380 PRINT "AMEND which field (1 TO "; A; ")?"
1390 INPUT J : IF J > A THEN GOTO 1380
1440 INPUT "Enter modified field now"; DS(J)
1445 IF LEN(DS(J)) < G(J) THEN FOR M := LEN(DS(J)) + 1 TO G(J) : DS(J) := DS(J) + " " : NEXT M
1450 AS(D) := LEFTS(AS(D), B(J)) + DS(J) + MIDS(AS(D), B(J) + G(J) + 1)
1490 IF D = R THEN J = – 1 : GOTO 1560
1500 IF D = 1 THEN J := 1 : GOTO 1540
1510 IF AS(D) > AS(D + 1) THEN J := 1
1520 IF AS(D) < AS(D – 1) THEN J = – 1
1540 IF LEFTS(AS(D + 1), 1) = "" AND J = 1 THEN GOTO 1630
1560 IF J = 1 THEN GOTO 1600
1570 IF AS(D) >= AS(D – 1) THEN GOTO 1630
1580 XS = AS(D) : AS(D) = AS(D - 1) : AS(D – 1) = XS : D = D – 1 : GOTO 1490
1600 IF AS(D) <= AS(D + 1) THEN GOTO 1630
1610 XS = AS(D) : AS(D) = AS(D + 1) : AS(D + 1) = XS : D = D + 1 : GOTO 1490
1630 HOME : CLS : RETURN
1650 PRINT "ARE YOU SURE YOU WISH TO DELETE?"
1660 RS := GETS(1)
1670 IF RS = "" THEN GOTO 1660
1680 IF RS <> "Y" AND RS <> "y": THEN HOME : CLS : RETURN
1690 HOME : CLS : PRINT " DELETING "
1700 Dd := D
1720 If D = R THEN Dd := Dd – 1 : GOTO 1750
1730 IF LEFTS(AS(1), 1) <> "" THEN AS(D) := AS(D + 1) : D := D + 1 : GOTO 1720
1750 FOR F := 1 TO 2000 : NEXT F : HOME : CLS : AS(D) := ""
1760 D := Dd : IF LEFTS(AS(1), 1) = "" THEN D = 0 : RETURN
1770 IF D = 0 THEN D := 1
1780 IF LEFTS(AS(D), 1) = "" THEN D = D – 1
1790 IF Md = 1 THEN RETURN
1800 K := 1
1820 IF MIDS(AS(K), B(Z) + 1, G(Z)) = ZS THEN GOTO 1860
1830 IF K = R OR LEFTS(AS(K), 1) = "" THEN Df := 1 : GOTO 870
1840 K := K + 1 : GOTO 1820
1860 Dd = D : Pa = 1
1880 IF LEFTS(AS(Dd), 1) = "" OR Dd = 0 THEN Pa = 2 : Dd = D : Mo = Mo – 1
1890 IF MIDS(AS(Dd), B(Z) + 1, G(Z)) = ZS THEN D = Dd : RETURN
1900 Dd = Dd + Mo : GOTO 1880
1920 HOME : CLS
1930 PRINT "Record number "; D; " " : FOR N := 1 TO A
1940 PRINT : PRINT NS(N) ; TAB (12); MIDS(AS(D), B(N) + 1, G(N))
1950 NEXT
1960 PRINT : PRINT : PRINT " F(orward) B(ack) M(enu) A(mend) D(elete) P(rinter) "
1980 VS := GETS(1) : IF VS = "" THEN GOTO 1980
1990 IF VS = "P" OR VS = "p" THEN PRINT #2, "Record number "; D; " " : FOR N := 1 TO A :
PRINT #2 : PRINT #2, NS(N); TAB (25); MIDS(AS(D), B(N) + 1, G(N)) : NEXT : PRINT #2 : PRINT #2
: PRINT #2 : GOTO 1980
2000 Op := 0 : IF VS = "F" OR VS = "f" THEN Op := 1 : Mo := 1
2010 IF VS = "B" OR VS = "b" THEN Op := 2 : Mo := – 1
2020 IF VS = "M" OR VS = "m" THEN Op := 3
2030 IF VS = "A" OR VS = "a" THEN Op := 4
2040 IF VS = "D" OR VS = "d" THEN Op := 5
2050 IF Op = 0 THEN GOTO 1980
2060 RETURN
```

Colin Raw/Tony Stone Photo Library,London

MODEL ASSEMBLY INSTRUCTIONS

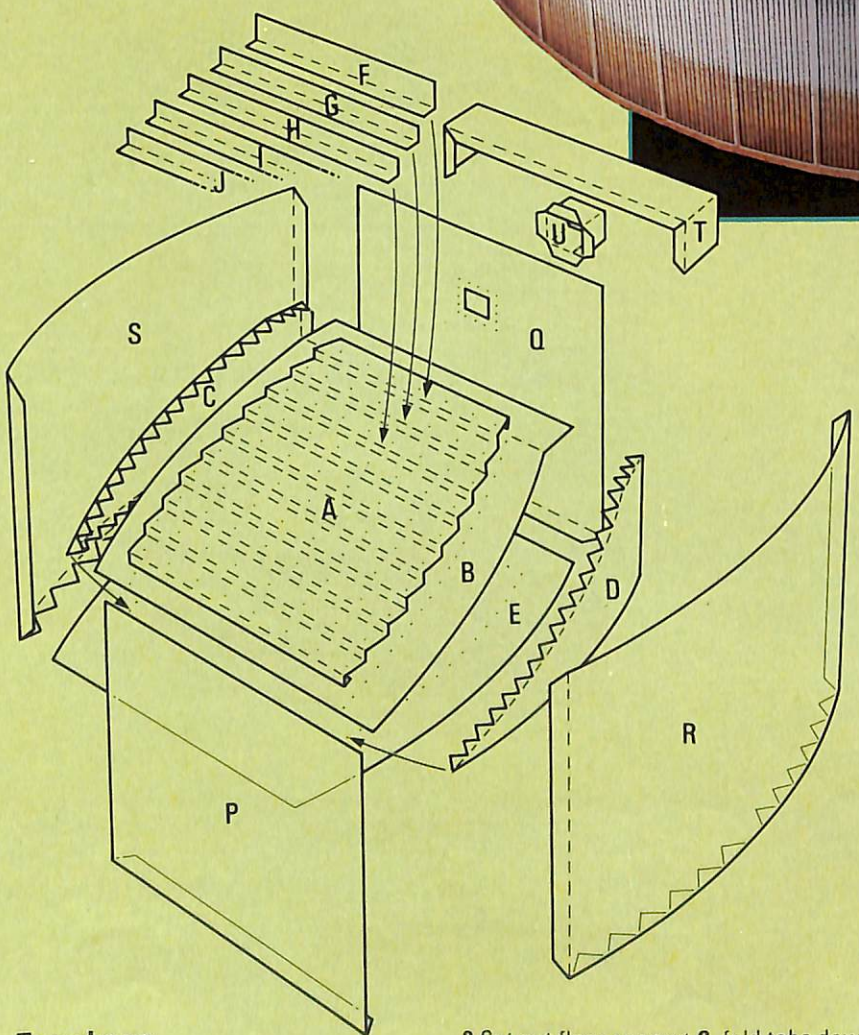
1 2 3 4 5

OMNIMAX CINEMA



You will need
Scissors • Ruler • Craft knife • Glue

Before cutting out the pieces, score along all broken lines with a blunt edge and ruler to make folding and gluing easier. Study the ASSEMBLY DIAGRAM to see how the pieces fit together, and use the dotted lines as a guide for positioning.
NB Younger children will need supervision when using a craft knife.



To make up

Base

1 Cut out seat bases **A** and fold into shape, making a series of sharp creases along the broken lines (see ASSEMBLY DIAGRAM). Cut out sloping floor **B**.

2 Cut out floor support **C**, fold tabs down and glue to edge of **B**. Repeat with floor support **D**.
3 Cut out base **E** and glue tabs on **C** and **D** to edge of **E**, ensuring that **B** slopes down on to blue strip on **E**.

4 Place **A** on **B**, using dotted lines as positioning guides. Make sure that narrower end of **A** is at top of **B**. Fold down flap at top end of **A**. Tuck flap at bottom of **A** under and glue into position on **B**. Spread glue down centre of **B** and stick **A** to **B**.

Seating

1 Cut out row of seats **F** and fold. Glue to top step of **A**, so that crease is along dotted line (black strip on **F** is above seat backs).
2 Cut out **G** and glue to next step down. Repeat with **H** to **O**, until bottom row of seats is in place.

Walls

1 Cut out screen **P** (23 metres across in real life) fold flap forwards, spread glue on upper side of flap and stick to underside of **E**, in front of seats.
2 Cut out entrance **Q** and cut window for projector with craft knife. Fold flap forwards and glue to **E** (see ASSEMBLY DIAGRAM).
3 Cut out wall **R** and position on left of **Q**, gluing folded tabs to **E** and side flaps to **P** and **Q**. Repeat with wall **S**, gluing it to right of **Q**.

To finish

1 Cut out canopy **T** and fold to shape. Glue flaps to top of **Q**.
2 Cut out projection box **U**, fold and glue into shape. Fold out tabs and glue tab undersides around edges of window.
3 To light up screen, shine torch through projection window.

QUEST PROJECTS

ENTERTAINMENT

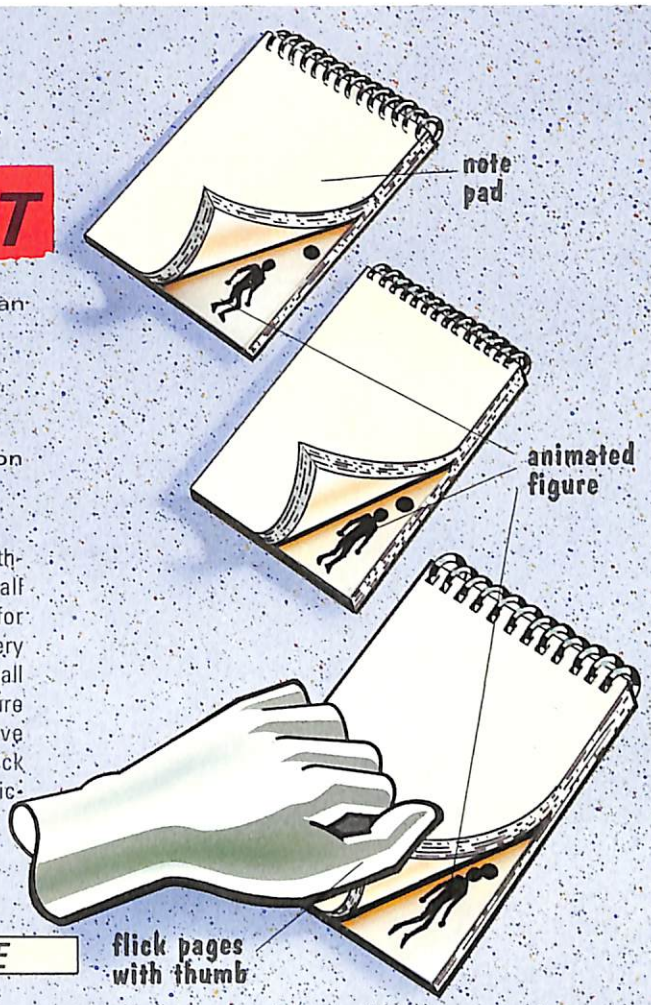
A truly moving picture cannot be recorded. So how can we see moving pictures at the cinema and on TV?

FLICK-BOOK

1 2 3 4 5

The flick-book demonstrates the persistence of vision that allows still images to apparently move.

You need a small notebook or 30-40 sheets of paper stapled together, a pencil and a set of coloured pencils. Draw or trace a small picture in the right-hand corner of the last page. Then repeat for the page above, altering the position of the image or parts of it very slightly. In the example shown, the footballer rises to meet the ball and heads it away. Use the picture below as a guide for the picture above. If you wish, you can colour the pictures. When you have finished drawing, pick up the corner of the book as shown and flick through it, using your thumb to regulate the speed. Look at the picture and watch it move.



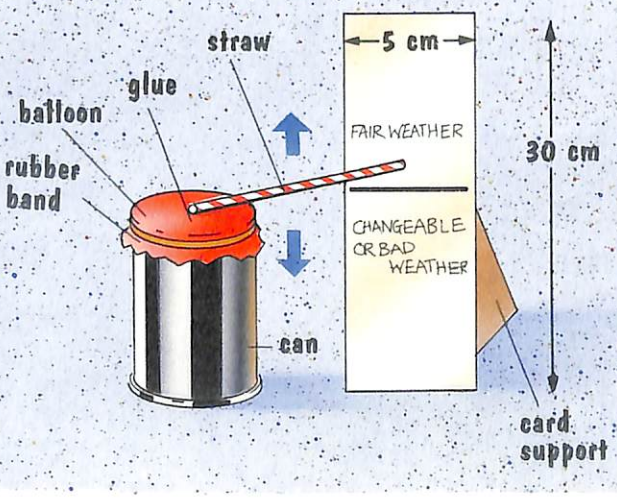
Simon Critchley

ADVENTURES IN THE WORLD OF SCIENCE

BAROMETER

1 2 3 4 5

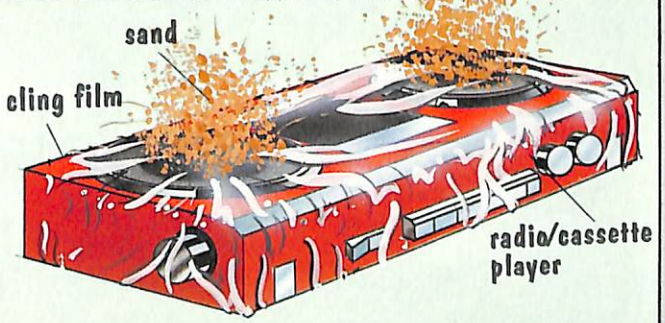
You need a tin can, a can opener, a balloon, a drinking straw, a rubber band, a sheet of card, a ruler, a pair of scissors, glue and some pens. Remove one end of the can, then wash and dry it thoroughly. Cut the balloon up one side, stretch it across the top of the can and secure it with the rubber band. Glue one end of the straw to the centre of the balloon. Cut a piece of card twice the height of the can and 5 cm wide. Draw a line exactly at the half way point and mark the card as shown. When the air pressure outside the can is greater than that on the inside the balloon will be depressed and the pointer will rise up the chart, indicating fair weather and vice-versa.



SEEING SOUND

1 2 3 4 5

You will need a powerful radio/cassette player, a pop tape, a roll of clingfilm and a cup of sand. Insert the cassette into the player, lay the player on its back, then stretch clingfilm over the whole of the machine. Sprinkle the sand over the stetched clingfilm and turn the machine on. The sand should jump around with the sound vibrations. If this doesn't happen try turning the volume up.



PROJECT INFORMATION

1 2 3 4 5

Each **QUEST** project and model has its own difficulty rating: 1 very simple, 2 simple, 3 intermediate, 4 advanced, 5 complicated.

WARNING!

Every care has been taken to ensure projects are as safe as possible. However, parents should supervise all projects. The publisher can accept no liability for injury.